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Reports
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A Fire History Study Conducted on the Monroe Mountain Demonstration Area

Richfield District
Fishlake National Forest and Bureau of Land Management

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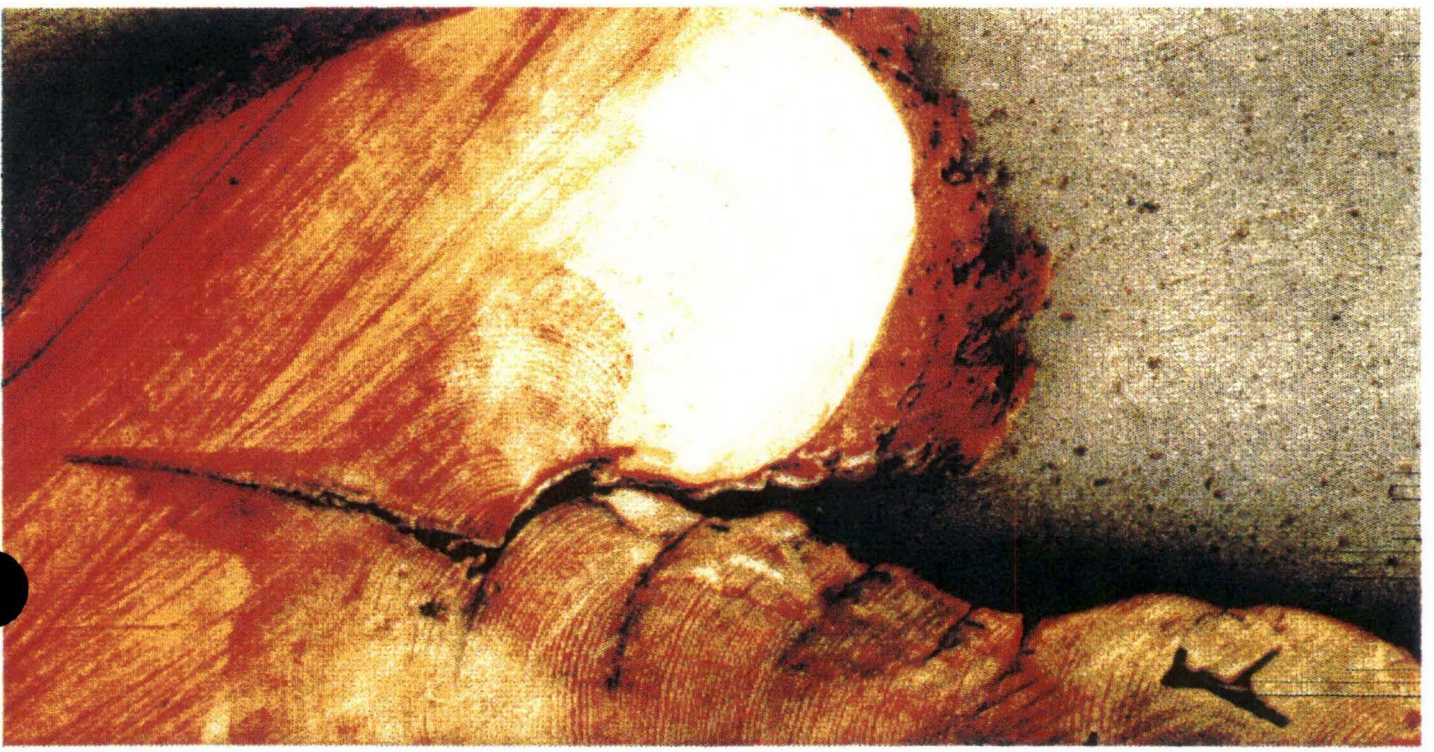
Richfield, Utah

February 1, 1997



Preparers

Linda Chappell authored this report with contributions from Robert Campbell and Kevin Greenhalgh. Noni Dalton, Robert Sanders, Lynn Findlay, Kevin Greenhalgh, Robert Campbell and Linda Chappell participated in the field work and lab analysis for this report.

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INTRODUCTION

"Before ecosystem management can be implemented or ecological integrity preserved, long-term ecosystem states and processes must first be quantified....Without a window to the past as a guide to where we might be going, it is impossible to institute meaningful ecosystem management." (Kay, 1995 in press.)

The Monroe Mountain Seeking Common Ground Demonstration Area, some 320,000 acres, lies in the heart of central Utah and extends south and east from Richfield. Within this area, the elevation ranges from 5120 feet at the Sevier Valley floor to Monroe Peak at 11,227 feet. The plateau, with its series of peaks, benches and rolling terrain which extend north and south for nearly 35 miles and up to 15 miles in width, is called Monroe Mountain. This area contains the entire Monroe Mountain Subsection of the Utah High Plateaus and Mountains Section in revised Bailey's ecoregion classification. Approximately 175,000 acres of this subsection is managed by the Fishlake National Forest. See Figure 1, next page.

As one scans the landscape, it becomes evident that the vegetation evolved with fire. It is also apparent that fires have not functioned within their historic cycle for more than a century. Prior to establishment of the Forest Reserves, most of the Intermountain Region had undergone major changes in plant cover as a result of extensive use (timber harvest and livestock grazing) and fire exclusion. The landscapes we see today, in most cases, do not resemble what was present when the first explorers arrived in the early 1800's. (Ogle and DuMond 1996, in press.)

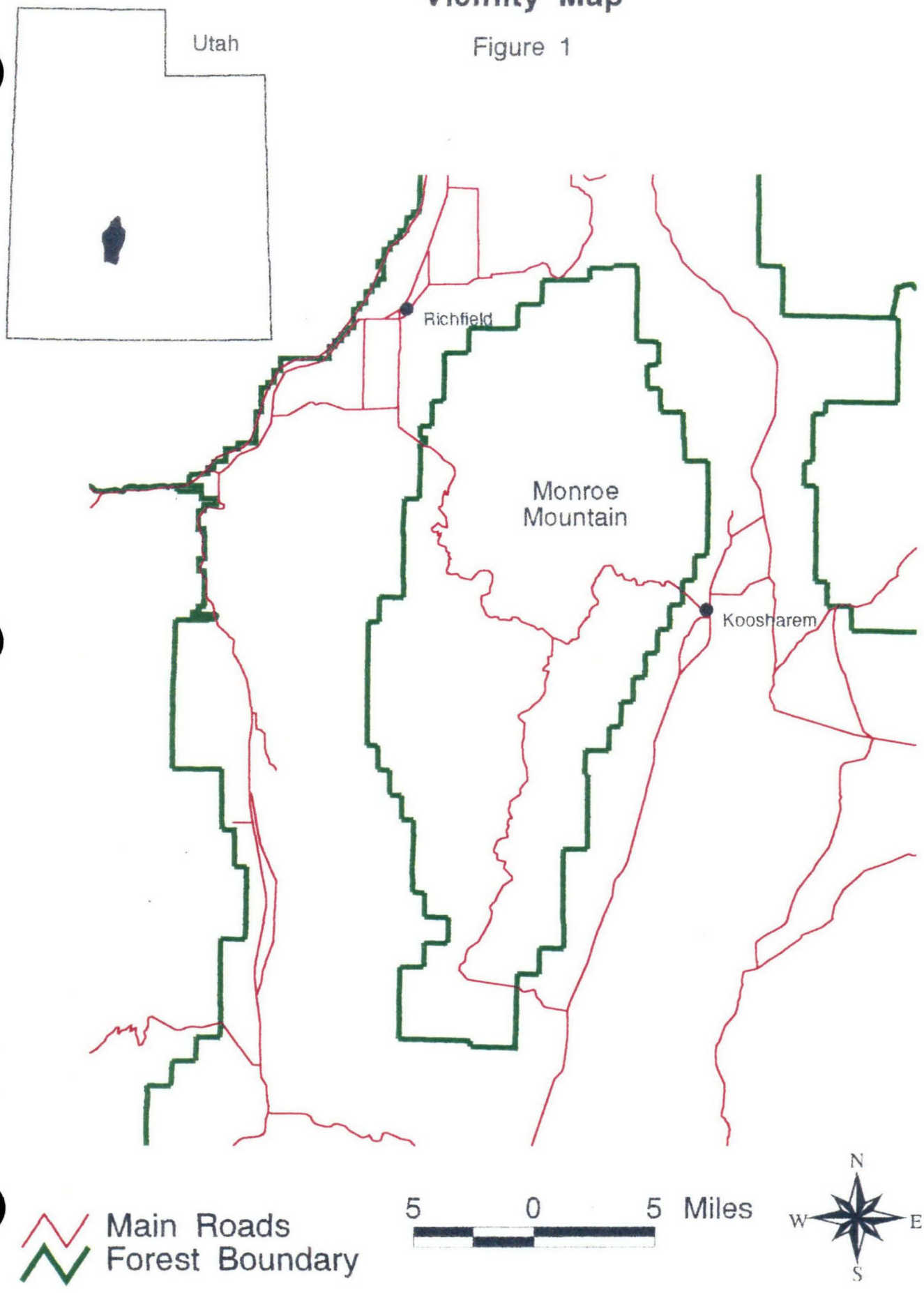
This study was undertaken to determine what fire's historic role had been in the Monroe Mountain ecosystem. There was no known local data on return fire intervals. When funding became available, it was determined that these were the primary data needed before considering reintroducing fire to the ecosystem. As with any investigation, many questions are left unanswered. These are discussed at the end of this document with the hope that someone will be intrigued enough to look further.

For millennia, wildfires have been a significant process which influenced the functioning of ecosystems on Monroe Mountain. Wayne Shepperd, Research Silviculturist, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, has done much of his research on quaking aspen. He stated, "knowing more about fire history is absolutely essential to understanding the dynamics of seral aspen ecosystems." (Personal Communication, February 1995.)

Fire exclusion and more intense human pressure on the natural resources in the past 100 to 150 years has changed the vegetation. Fire exclusion includes fire suppression, livestock grazing, reduction in numbers of native Americans (or moving them out of the area), and timber harvesting.

Vicinity Map

Figure 1



Settlers came into the Sevier Valley in the early 1860s. They brought livestock with them and needed timber to build houses, barns and fences. By the 1870s many of the surrounding valleys were also settled, further increasing pressure on the vegetative resources. Valleys were grazed by livestock during the winter which then followed the green vegetation up the mountains for summer ranges. Families moved their dairy herds to the mountains during the summer, not only the forage, but the streams enabled them to keep their dairy products cool. As there were no permits, forage was used as it was available. This resulted in denuded areas which were regrazed as soon as more vegeation had grown.

This intense grazing removed much of the fine fuel which had previously carried the frequent low-severity fires. Ogle and Dumond (1996, in press) state that interrupting these frequent surface fires, " resulted in the accumulation of a deep litter layer in the frequent, low-severity fire regime, and the disruption of the fire cycle. Nutrient cycling and decomposition rates slowed significantly when fire was removed from these dry ecosystems."

METHODS

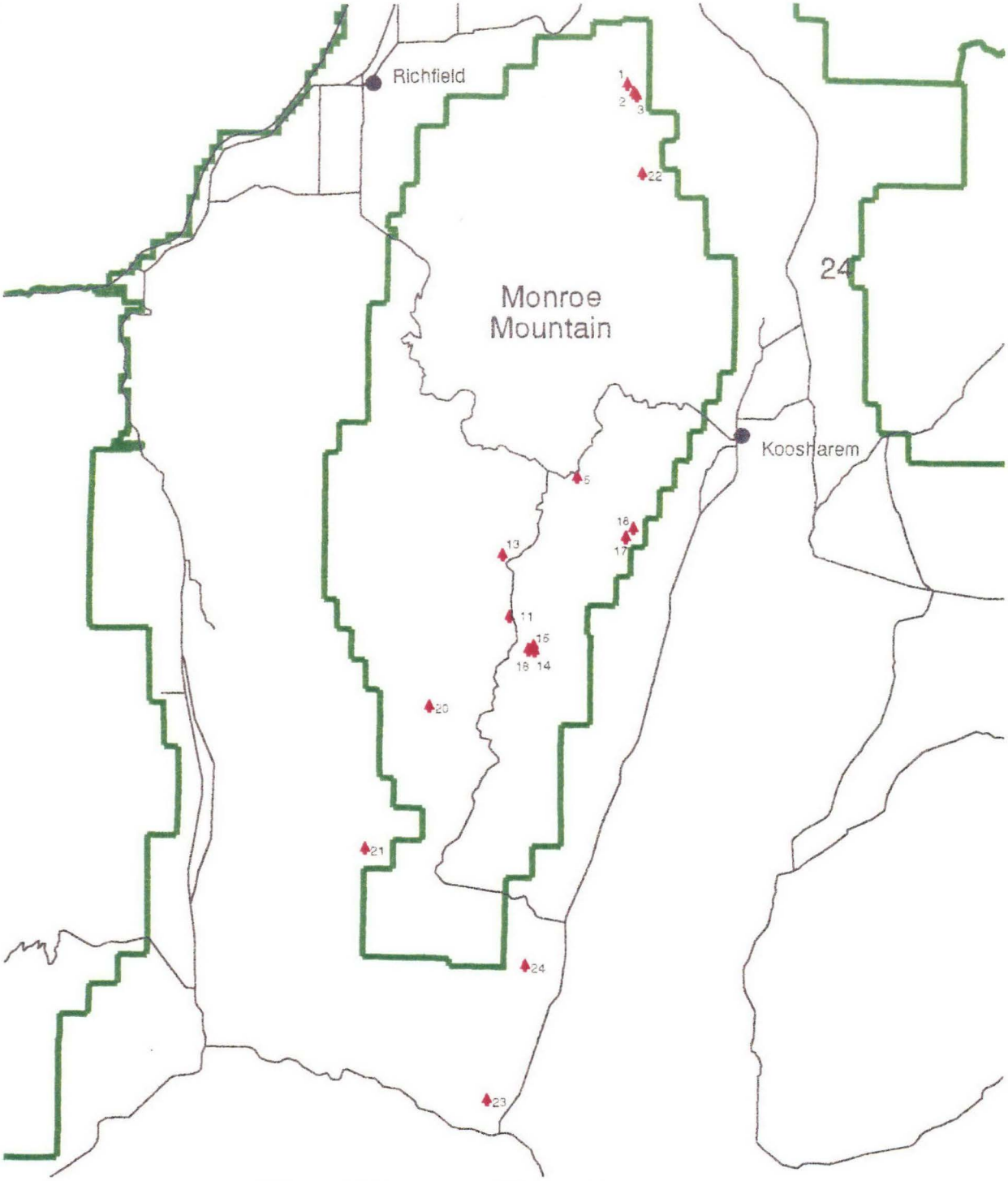
We sampled more than 40 trees with burned cat-face scars on Monroe Mountain and looked specifically for large, open- crowned ponderosa pine, the excellent fire scar recorders. We also sampled pinyon/juniper, aspen, and Douglas fir when it could be determined that fire caused the scar. Where it was deemed safe to do so, partial slices were removed near the tree's base without killing the tree, as recommended by Arno and Sneck, 1977. If major hazards existed, we dropped the tree and then cut slices from the base.

Samples were taken in 16 different areas that ranged in elevation from 7,000 to 9,800 feet. Seven areas were in the subalpine fir/Oregon grape habitat type but had a variety of existing cover types: ponderosa pine, quaking aspen, and Douglas fir. Three of these areas were adjacent, and their data were lumped together into a single site. Three areas were in the white fir/mountain mahogany or white fir/Oregon grape habitat type. The last five areas were in the pinyon/juniper woodlands, a significant cover type in the lower elevations of the Monroe Mountain ecosystem. See Figure 2, next page, for a map of the site locations.

Fire scars were marked and samples labeled initially in the field. After sanding, the rings were counted in the lab with the use of a magnifying lens. All samples were aged twice, usually by different people. Aging started at the cambium, and rings were labelled every decade to the pith or available edge. Data sheets were completed in the lab while aging the samples. Data included the year the tree was cut, any fire scar years and the pith year if present.

Keep in mind that a tree must be exposed to a fire with enough intensity to scar the trunk to become a "recording tree". There is a distinct possibility that low intensity ground fires may not be detected using the methodology from this study. This means that these data reflect the minimum number of fires in an area, so the summarizations and mean fire intervals are conservative at best.

We determined a master fire chronology for each site which included all samples taken from that site. Then we used the master fire chronology to determine the fire free intervals and calculate the mean fire free interval for each site. The range of years for the fire free intervals for each site and number of years since the last fire are also listed. The raw data were then summarized by fire group.



Fire History Plot Locations
Fishlake National Forest
1994 Field Season

Figure 2

10 0 10 20 Miles

Roads
Forest Boundary
Tree Sample Sites

CONSERVATION LEADER

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RESULTS

Habitat types were used to determine which Bradley et al. (1992) fire group the sample sites represented. "Fire groups are based on the reponse of the dominant species after fire occurance and the similarity of development in postfire succession....The successional path taken by any given site following fire depends on many variables. Preburn vegetation, size and severity of the fire, topography, climate and soil, and chance all contribute to the process. "(Bradley et.al., 1992) The successional pathways are included to support the fact that the reintroduction of fire to an ecosystem can create myriad vegetational results based on how fire is applied at any given moment in time. For more specific information, a copy of the publication is recommended (Fire Ecology of Forests and Woodlands in Utah, General Technical Report INT-287, 128 pp.).

The Monroe Mountain data and summarizations are presented in order of most area represented to least area represented in the Monroe Mountain Study area. The dry lower subalpine habitats predominate, the next most common vegetation cover is white fir and blue spruce with pinyon-juniper woodlands the third most dominate. The drier Douglas fir habitat type data are included although we did not have enough samples to generate an analysis of the mean fire interval for that type.

Dry Lower Subalpine Habitat Types Fire Group 10

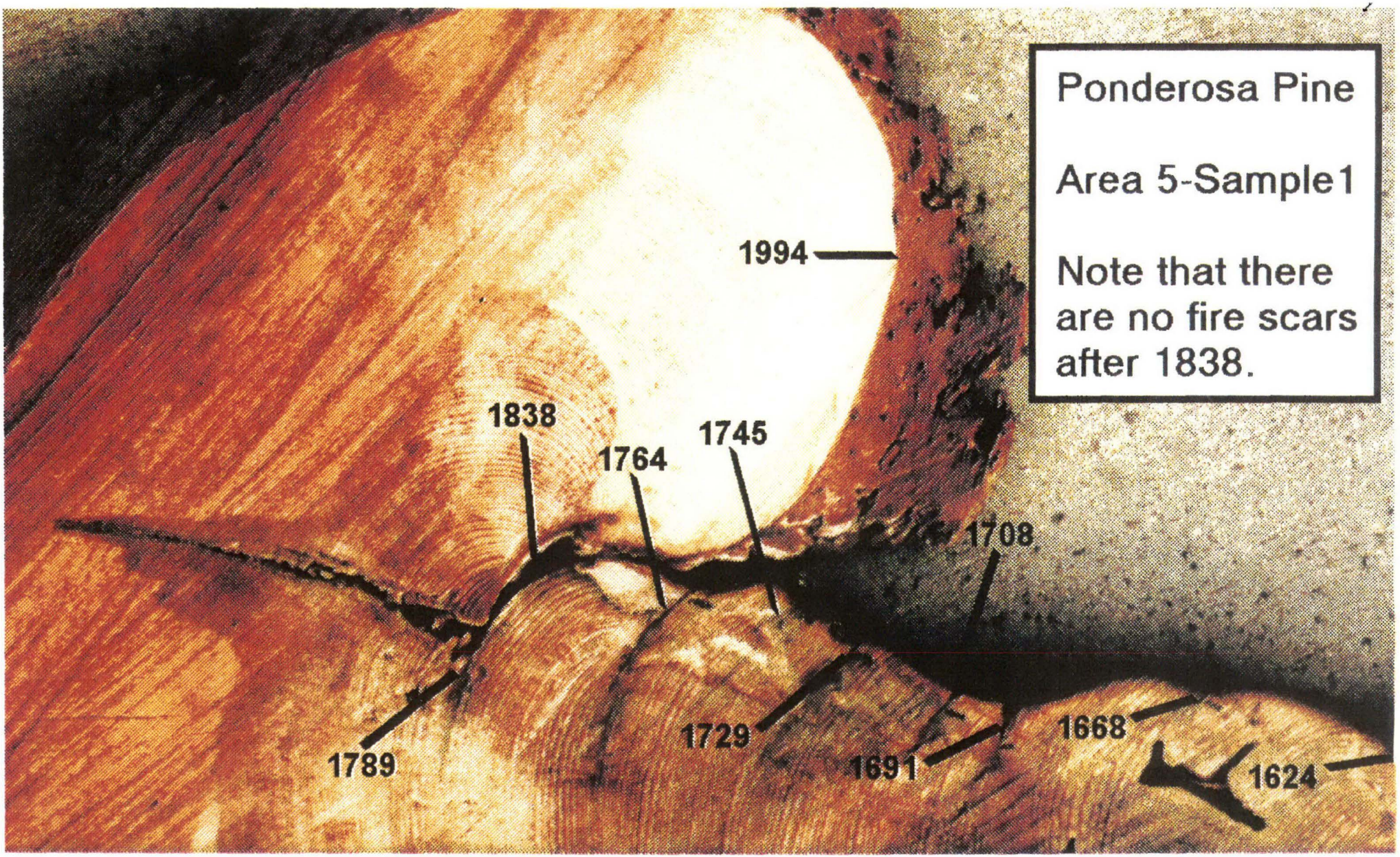
Seven different areas were sampled in this fire group because it represents a considerable amount of Monroe Mountain.

Area 5 Lower Box Creek

Two ponderosa pine were sampled in this stand of mostly Douglas fir. Two trees were sampled and both were excellent fire recorders (king trees) with 9 and 10 fires respectively. Prior to 1838, the area burned about every 19 years. Since then there is no evidence of fire recorded on the sample trees. This 156 year span is **8 times the length of the mean fire interval** prior to 1838.

Fire exclusion has probably created an atypically high fuel load. A fire in the area now would be much more intense than the more frequent (probably lower intensity) fires of the past. A picture of the partial cut is included on the next page. Note the regular fire scars through the mid-1800s then the large growth with no fire scars(the large chunk in the upper half of the picture) until 1994 when the sample was taken.

Cover Type: Douglas fir
Habitat Type: subalpine fir/Oregon grape
Elevation: 8700 feet
Aspect: northeast
Master Fire Chronology: 1598-1838
Number of Fires: 14
Mean Fire Interval: 19 years
Interval Range: 6-30 years
Years Since Last Fire: 156 years


Ponderosa Pine
Area 5-Sample1
Note that there are no fire scars after 1838.
1994
1838
1764
1745
1708
1789
1729
1691
1668
1624

Area 11 Willis Spring

This site had four sample trees: three scarred Douglas fir and one aspen. The second Douglas fir has a lot of rot, and there is a good chance that there may be three more undateable fire scars in it. The stand is dominated by old Douglas fir on top of the ridge, gradating to spruce/fir with some understory aspen as the area flattens out below the ridge. The 64 year fire free span is **3 times the length of the previous mean fire interval**.

Cover Type: spruce/fir
Habitat Type: subalpine fir/Oregon grape
Elevation: 9300 feet
Aspect: northeast
Master Fire Chronology: 1753-1930
Number of Fires: 11
Mean Fire Interval: 20 years
Interval Range: 6-41 years
Years Since Last Fire: 64 years

Areas 14, 15, and 16 Langdon Creek (samples were lumped into one site for analysis)

This site is dominated by spruce and fir. The Douglas fir is an older stand remnant. Nine samples were taken, one from a scarred Douglas fir and eight from unscarred, post-fire trees. Ages of the aspen were used to determine the approximate year of the two most recent burns since aspen roots send up new suckers following a fire. It has been 109 years since the last fire, **nearly two and one half times** the length of the historical mean fire interval.

Cover Type: spruce/fir
Habitat Type: subalpine fir/Oregon grape
Elevation: 9600 feet
Aspect: north
Master Fire Chronology: 1663-1885
Number of Fires: 6
Mean Fire Interval: 45 years
Interval Range: 8-72 years
Years Since Last Fire: 109 years

Area 20 Dry Creek Canyon

This site contained an overstory mix of subalpine fir and ponderosa pine with an aspen and gambel oak component. The main canyon faces southwest and this site is in the mouth of a side canyon which faces northwest. At this site it has also gone **two and one half times the mean fire interval** since the last fire was recorded over 75 years ago. The mean fire interval is 30 years.

Cover Type: pondersoa pine
Habitat Type: subalpine fir/Oregon grape
Elevation: 7900
Aspect: west
Master Fire Chronology: 1710-1920
Number of Fires: 8
Mean Fire Interval: 30
Interval Range: 4-63
Years Since Last Fire: 75

Area 22 Big Lake

This sample site was in a small saddle on a low conifer-covered ridge between two small clearings above Big Lake. This area has a mean fire interval of 37 years but has not burned in more than 161 years. This site has gone without a recorded fire **more than four times** what the data indicate would be an average return fire interval.

Cover Type: spruce/fir
Habitat Type: subalpine fir/mountain gooseberry
Elevation: 9500
Aspect: northeast
Master Fire Chronology: 1796-1833
Number of Fires: 2
Mean Fire Interval: 37
Interval Range: 37
Years Since Last Fire: 161

Composite Master Fire Chronology
Dry, Lower Subalpine Habitat Types Fire Group 10

Site Number	Number of Fires	Mean Fire Interval	Range of Years Between Fires	Years Since Last Recorded Fire
5	14	19	6-30	156
11	11	20	6-40	64
14,15,16	6	45	8-72	109
20	8	30	4-63	75
22	2	37	37	161

Avg. of Mean Fire Interval = 30 Avg. of Years Since Fire = 113

The average number of years since the last fire is 113. This is almost **four times** longer than the fire history (presettlement) mean fire interval of 30 years. The current role of fire in these ecosystems has been changed from the pre-settlement historical role.

This 30-year interval was difficult to compare with other studies. Not much research was found which had been done in this fire group for Utah. Although a fire history was completed in the Blue Springs/Reed Valley area on the Dixie National Forest in 1994, the data were not calculated by fire group, so it was impossible to compare results (Ogle, 1994). In a study done in the northern Rocky Mountains, Arno (1980) suggests that intervals of 50 to 130 years are probable in subalpine fir habitats. Jenkins (1994) proposes a pre-settlement mean fire interval of 7.5 years in the mixed-conifer/aspen community of Bryce Canyon National Park. It appears that the data were collected over a wide area and summarized as a single mean fire interval rather than site by site (as in this study) which would create a shorter mean fire interval for the Bryce Canyon area.

Fuels

This change in fire frequency, in additon to other factors such as insect and disease occurance, microsite climate changes, and land use practices, has affected the fuels component in the ecosystem. The types and amounts of fuels available have changed in response to the processes listed above, and altered the fire regime of the area. In the past, many fires were likely low-intensity, surface fires that burned through portions of the area fairly regularly as was noted in the fire history conclusions. This does not preclude infrequent stand-replacing fires from occuring.

In contrast to that historical fire regime, the fires of today are likely to be more intense, less regular, and have a greater probability of getting into the crowns and becoming large fires. This increased possibility of crown fires is due in part to the higher dead and down fuel loads that result from an increased incidence of insect and disease mortality, along with the natural accumulation of an older, thicker forest cover type. Also contributing is the increased presence of ladder fuels, due to the continued conversion from aspen dominated stands to those dominated by conifer species such as Douglas fir, Engelmann spruce, subalpine fir and white fir. Bradley et.al. (1992) state, "the heaviest downed woody fuel loads in Utah forests can be expected in Fire Group Ten.... Live and standing dead fuel can contribute significantly to overall fire hazard."

The fuels in the analysis area can best be described as a combination of fire behavior Fuel Models 8 and 10. Fuel Model 8 best characterizes the aspen-dominated stands and open-conifer stands with little undergrowth where the fire would be carried primarily in the litter layer and the

downed woody material such as dropped branches and downed trees. Fires in this fuel type typically have low rates of spread and shorter flame lengths. Fires in the more dense, conifer-dominated stands are best described by Fuel Model 10. This fuel model is typified by a higher accumulation of 3-inch and larger dead and down woody material resulting from overmature situations with deadfall and insect and disease damage. Fires in this fuel type have higher rates of spread and higher flame lengths that contribute to the heightened possibility of crowning, torching, and spotting that makes control more difficult. Hal Anderson, in Aids to Determining Fuel Models for Estimating Fire Behavior (1982), provided the following comparison of the rate of spread(ROS) and flame length(FL) between the fuel models above, when the dead fuel moisture is 8 percent, live fuel moisture is 100 percent and midflame windspeed is 5 miles/hour:

Fuel Model 8 -	ROS: 1.6 chains/hour	FL: 1.0 feet
Fuel Model 10 -	ROS: 7.9 chains/hour	FL: 4.8 feet

It should be noted that fires in Fuel Model 10 with the values listed above are at the upper limit of control by direct attack. Worsened conditions would have a higher probability of escape. (Anderson, 1982)

The successional pathway from Bradley, et al. (1992) is included on the next page to illustrate the many effects a fire may have on a project-level planning area. The severity of the planned fire can create a wide variety of post-treatment effects. For example, in circle C of the illustration, a mature aspen (POTR) overstory with a conifer understory (PSME, PIEN, ABLA or ABCO) reacts very differently with a low severity fire than a severe fire. After a low severity fire, there would be an open aspen pole stand with some conifer regeneration. The severe fire would create a grass-forb dominated community. Project planners as well as prescribed fire managers will need to determine what outcomes are desired before applying fire as a tool in vegetative management projects.

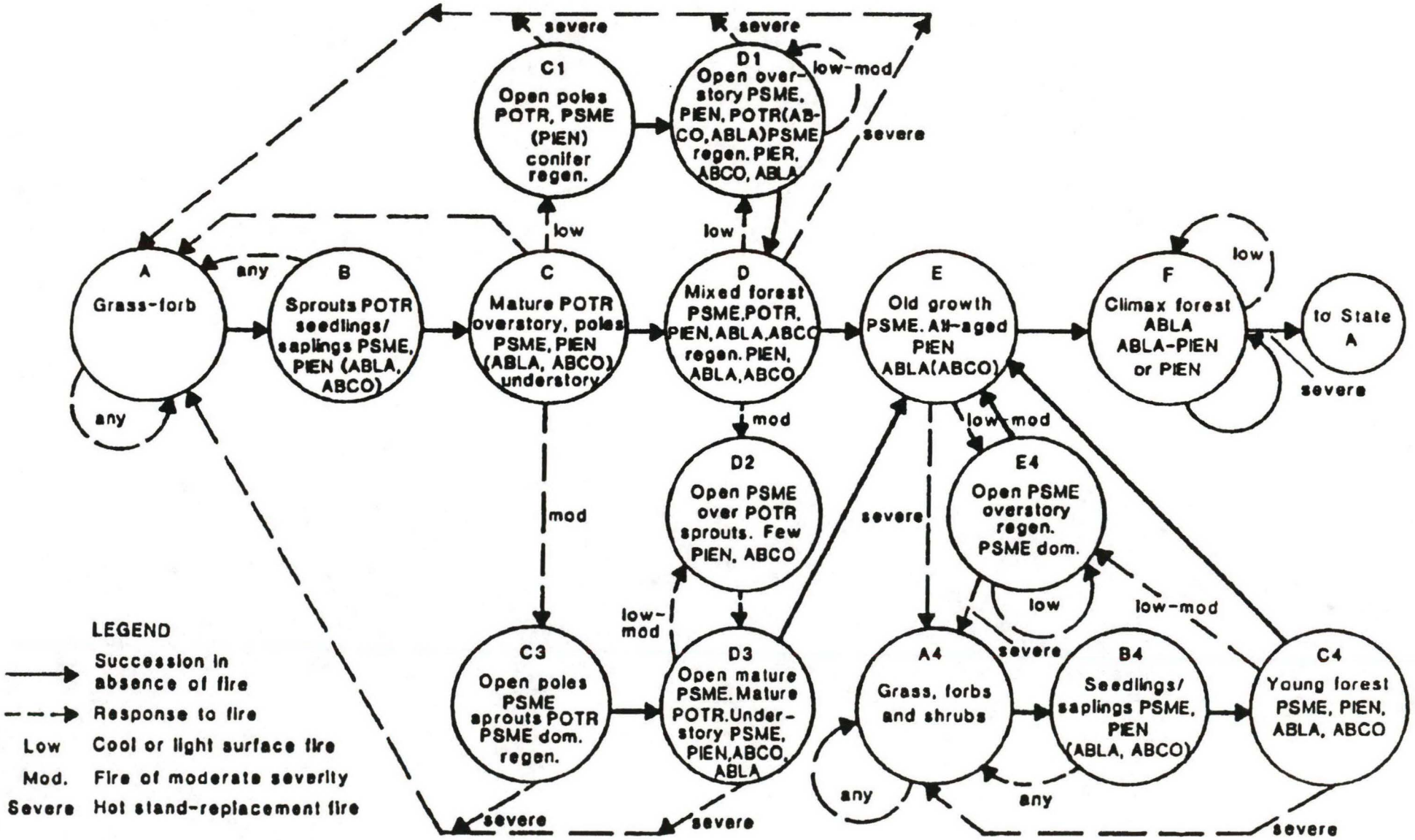


Figure 4 —Hypothetical fire-related successional pathways for habitat types in Fire Group Ten where a mixture of species occur during succession.

This diagram shows that a single fire can create many different vegetational outcomes.

Pinyon-Juniper Woodlands Fire Group One

Area 17 Above Greenwich

This area is a pinyon/juniper foothill with a sagebrush and grass understory. This juniper sample tree was located in a saddle. This area has gone 179 years without a recorded fire, **more than four times the mean fire interval** shown in the data. The interval range between fires is very wide (5-101 years), so this may be an area which does not have fires on a standard or regular frequency. This may indicate some sort of infrequent or cyclic burn pattern.

Cover Type: pinyon/juniper
Habitat Type: pinyon/juniper
Elevation: 8200 feet
Aspect: flat
Master Fire Chronology: 1687-1815
Number of Fires: 4
Mean Fire Interval: 43
Interval Range: 5-101
Years Since Last Fire: 179

Area 18 Above Koosharem

This is another pinyon/juniper foothill on the east side of Monroe Mountain. This sample was discounted because only one fire was found, making it impossible to determine a mean fire interval.

Cover Type: pinyon/juniper
Habitat Type: pinyon/juniper
Elevation: 8200 feet
Aspect: west
Master Fire Chronology: 1755-1994
Number of Fires: 1
Mean Fire Interval: 239
Interval Range: N/A
Years Since Last Fire: 239

There were not any trees sampled at Area 19

Area 21 The Elbow

This was a pinyon/juniper overstory with some sagebrush and grass understory. In the 98 years since the last recorded fire, there has been quite a change in the standing fuels. Ninety-eight years is nearly **three times longer than** the average historical fire occurance.

Cover Type: pinyon/juniper
Habitat Type: pinyon/juniper
Elevation: 6300
Aspect: west
Master Fire Chronology: 1766-1896
Number of Fires: 5
Mean Fire Interval: 33
Interval Range: 27-42
Years Since Last Fire: 98

Area 23 West of Otter Creek

This site included a juniper almost 600 years old. This is one of two sites which has not exceeded its average mean fire interval (66 years). This site has fourteen years until it reaches the average reburn year. Again, as with other sites, there is a wide variation in years between fires which was not analyzed.

Cover Type: pinyon/juniper
Habitat Type: pinyon/juniper
Elevation: 9500 feet
Aspect: east
Master Fire Chronology: 1793-1942
Number of Fires: 4
Mean Fire Interval: 66
Interval Range: 30-102
Years Since Last Fire: 52

Area 24 West of Angle

This site is also short of its average mean fire interval. According to our data the area will be due to burn sometime within the next 11 years (on average).

Cover Type: pinyon/juniper
Habitat Type: pinyon/juniper
Elevation: 7300 feet
Aspect: southwest
Master Fire Chronology: 1829-1946
Number of Fires: 3
Mean Fire Interval: 59
Interval Range: 48-69
Years Since Last Fire: 48

Composite Master Fire Chronology
Pinyon-Juniper Woodlands Fire Group 1

Site Number	Number of Fires	Mean Fire Interval	Range of Years Between Fires	Years Since Last Recorded Fire
17	4	43	5-101	179
21	5	33	27-42	98
23	4	66	30-102	52
24	3	59	48-69	48

Avg. of Mean Fire Interval = 50 Avg. of Years Since Fire = 94

The average mean fire interval based on the above data is 50 years. This is a longer interval than some of the other pinyon-juniper studies done. Bradley, et al. (1992) cite Burkhardt and Tisdale's 1976 work in southwestern Idaho. They found fire free intervals on 23, 18, 8 and 11 years on four different sites between the years of 1840 to 1910. They also cite Aldo Leopold's 1924 suggestion that fire occurred at intervals of 10 to 30 years in Arizona pinyon-juniper stands.

We suspect that the data here do not reflect the actual burn patterns occurring in pinyon-juniper. Some lower severity ground fires may not cause scars and would not show up in this fire scar study. Again, as in Fire Group 10, conservative estimates of the number of fires. It is likely that there were many more low severity (non-scarring) fires in the pinyon-juniper woodlands before settlement.

One of the difficulties observed while trying to find fire scars in pinyon-juniper is that the juniper often exhibited charred outer bark, but the fire severity was not high enough to create a scar. This makes the fire undateable unless there are other trees nearby which were scarred. Pinyons are thin barked and are easily killed by lower intensity fires that may scar thicker barked trees.

Fuels

The average number of years since the last fire is 94 years. The length of time since the last burn is twice the average time between fires the trees recorded historically. The fire regime has converted from one with a short return interval, light to moderate surface fire to a long return interval moderate to severe stand-replacing fire.

As a canopy closes in pinyon-juniper it becomes increasingly difficult to obtain a ground fire because there are few understory plants for fine fuels. The stand then requires a crown fire to burn which can be difficult to achieve with hand ignition techniques. To effectively burn the stand requires some type of enhanced ignition device, such as a helitorch or terra-torch, to get more heat into the crowns. Enhanced ignition devices cost more to use; to maintain cost efficiency, the burning project must cover more acres. Obviously, the fuel arrangement has changed and affects how fire can or will be utilized as a tool for vegetation manipulation.

Bradley et.al. (1992) cover the fire management considerations of pinyon-juniper woodlands concisely. The value of commodity outputs such as posts, poles,nuts, browse and forage from these areas will continue to increase as the human population increases. Also, that fire is an

appropriate tool to inexpensively increase availability of many of these commodities. Fire used carefully, can increase stand diversity (both age and size) and maintain or improve productivity.

The following diagram, Hypothethetical fire-related successional pathways for Fire Group 1, (Bradley et. al., 1992) is included to illustrate the many vegetative possibilities fire can create in an ecosystem. Notice that until the stand reaches pole size or is uneven-aged, any fire will return pinyon-juniper to a grass and forb mix for some time. Also, succession in the absence of fire is very different than when fire is present. The data we analyzed indicated that the pinyon-juniper stands in the Monroe Mountain area were regularly influenced by fire prior to settlement.

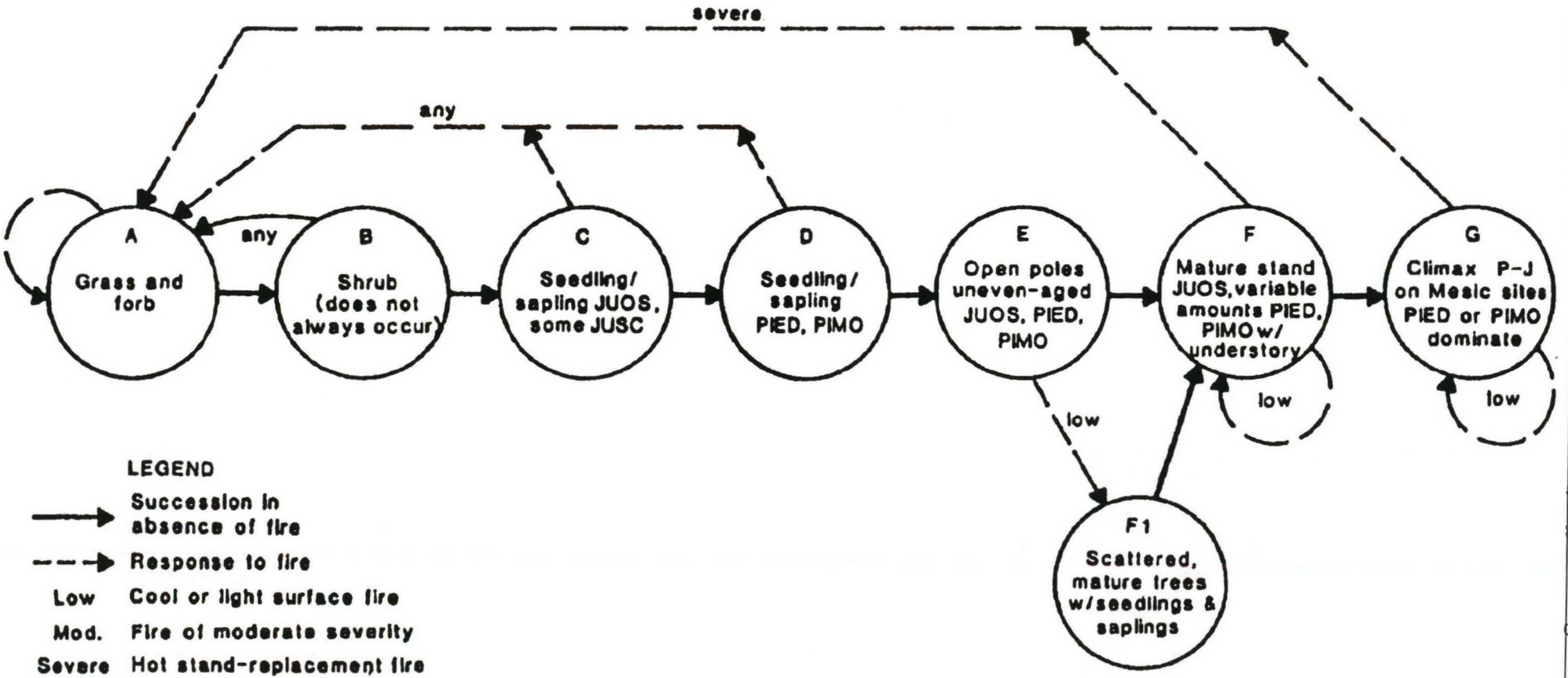


Figure 5 —Hypothetical fire-related successional pathways for Fire Group One.

This diagram shows that a single fire can create many different vegetational outcomes.

White Fir and Blue Spruce Habitat Types Fire Group Six

Area 1 Lone Pine Ridge

A ponderosa pine, two aspen and a Gambel oak were sampled in this mixed open stand. Only one fire was found. This area was dominated with Gambel oak, aspen and big sagebrush with some mountain mahogany, ponderosa pine and subalpine fir. There were volcanic boulders scattered through the surface.

Cover Type: aspen
Habitat Type: white fir/mountain mahogany
Elevation: 8240
Aspect: flat
Master Fire Chronology: 1965
Number of Fires: 1
Mean Fire Interval: not applicable
Interval Range: not applicable
Years Since Last Fire: 29

Area 2 Hunter's Flat Road

A ponderosa pine and an aspen were sampled on this site. Five fires were recorded in the ponderosa and the aspen sprouted the same year as one of the fires. The mean fire-free interval is 42 years with 92 years since the last fire. This would make **the mean fire interval more than twice** the historical average. The earliest fire was recorded in 1733.

Cover Type: aspen
Habitat Type: white fir/Oregon grape
Elevation: 8350
Aspect: north
Master Fire Chronology: 1733-1902
Number of Fires: 5
Mean Fire Interval: 42
Interval Range: 20-71
Years Since Last Fire: 92

Area 3 Lone Pine Ridge Road

We found one ponderosa pine with a single scar in 1804. The center was rotten, but the tree was older than 1738 making it 256 years plus.

Cover Type: ponderosa/aspen
Habitat Type: white fir/Oregon grape
Elevation: 8350
Aspect: north
Master Fire Chronology: 1884
Number of Fires : 1
Mean Fire Interval: not applicable
Interval Range: not applicable
Years Since Last Fire: 110

We did not sample trees in Area 4.

Composite Master Fire Chronology
Summary for White Fir and Blue Spruce Habitat Types Fire Group Six

Site Number	Number of Fires	Mean Fire Interval	Range of Years Between Fires	Years Since Last Recorded Fire
1	1	N/A	N/A	29
2	5	42	20-71	94
3	1	N/A	N/A	110

*Note-There was insufficient data in this habitat type to infer a mean fire interval.

Three sites were sampled in this habitat type. All were located toward the north end of Monroe Mountain. This area keyed out as a white fir habitat type and had some remnant ponderosa pine. All scars were found in ponderosa pine with corroborating data taken from aging the surrounding aspen stands. There was evidence of a previous generation of ponderosa pine in old stumps and logs. This area was difficult to sample, many possible recording trees were too decayed to use. Still, utilizing the data available, the time since the last fire is **double the mean fire interval.** Again, fire exclusion has changed the fire regime for the area. No comparable fire histories for this fire group in Utah were found in the literature.

Fuels

Summarized fuel loading information for white fir and blue spruce habitat types in Utah is not available. Fuel estimates for mixed-conifer stands in neighboring Arizona should be comparable to Utah stands. Historical loadings in the mixed-conifer type were probably no more than one-fourth to one-third of present-day loadings, or 12.14 to 18.20 tons/acre (Bradley et.al., 1992). As in Fire Group10 fuels, the character of these fuels has also changed. There are increased levels of ladder fuels creating a potential for crown fires.

Drier Douglas fir Fire Group Four

Three sample sites were located in this habitat type. Only one site had usable data. The master fire chronology only exists from 1931 to 1983. There were four fires with a mean fire interval of 17 years. The fires ranged from two to thirty years apart with eleven years since the last fire.

Area 10 was deleted when we determined that the scar present was caused by logging damage.

Area 12 was deleted because we could not determine conclusively that the scars were caused by fires.

Area 13 Rock Spring

This Douglas fir was on a northwest slope on a rocky knoll. The dominant species was mountain mahoghany with few Douglas fir interspersed. Three possible fire-scarred trees were found in the general area. The sample is from the tree with the most prominent scar.

Cover Type: Douglas fir
Habitat Type: Douglas fir/mountain mahogany
Elevation: 8500 feet
Aspect: northwest to flat
Master Fire Chronology: 1931-1983
Number of Fires: 4
Mean Fire Interval: 17
Interval Range: 2-30
Years Since Last Fire: 11

This sample falls into Fire Group 4: drier Douglas fir habitat types. There are some inclusions on rocky outcrops which key out to this Douglas fir/mountain mahogany habitat type, but we do not have conclusive data from these areas to determine a usable mean fire interval. The data are presented in the hope that they may be used during a later study.

MANAGEMENT CONSIDERATIONS

One key managment question still must be answered. At what level do we manage? A set of "natural" fire regimes may in fact be represented by these data; however, it would be difficult to replicate due to changes which have occurred in fire regimes and human development of the area over the last 100 years. There are now radio towers, powerlines, cabins, campers, fences and many more users than during the time represented by these fire history data.

"Mankind is the greatest modifier of the fire environment, especially its fuels. With or without fire, by design or by accident, a fire regime is shaped by human activities. The study of a 'pure' fire regime, so dear to the American ecologists, is a fantasy. No regime exists that has not to some extent been modified by human activity and has not to some degree adapted to anthropogenic fire practices....Fire has been used by humans for centuries. We are now more cognizant of fire behavior and fire effects on entire ecosystems than ever before." (Pyne, 1982).

As evidence of this, in 1993 Steele and Arno testified about forest health in Idaho before the U.S House of Representatives. They stated that "the health of national forests is closely related to changes in the role of fire....Since the early 1900's, fire suppression has become effective at controlling low and moderate intensity fires. This has led to development of dense stands of drought-stressed trees which are highly vulnerable to insect and disease epidemics. Ironically these forests are now more susceptible to severe wildfires."

Interestingly, the same process is at work in Utah, and forests are beginning to show declining forest health. The 1995 Aerial Detection Survey for the Fishlake National Forest reports subalpine fir mortality to be at epidemic levels forest wide. The survey also states that the Beaver District is experiencing a mountain pine beetle epidemic. This species is known to effectively attack older, overmature trees. The Richfield District is experiencing a spruce beetle epidemic on the north end of the district. The survey states that in 1994 the Fishlake data reflected 40,215 dead trees; in 1995 this jumped to 110,700 dead trees (Anhold, 1995).

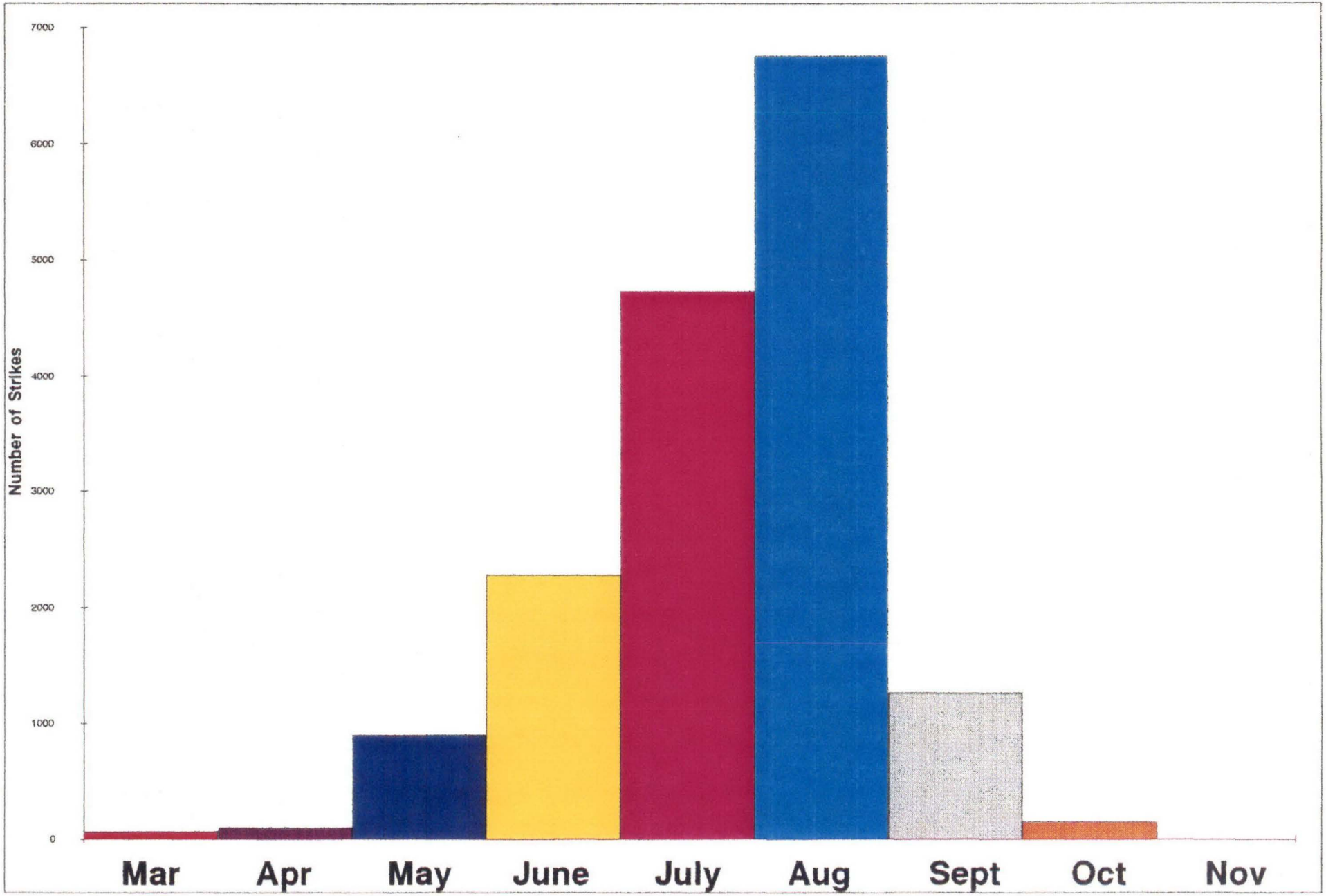
Preliminary data supplied by Renee O'Brien of the Intermountain Research Station's Forest Inventory and Analysis project show about 55% of the historically aspen dominated landscapes on the Fishlake National Forest have converted to mixed-conifer with some aspen. The amount of aspen dominated landscapes has declined from 314,000 acres to 142,000 acres. This loss of

aspen cover could be critical due to the age of the genetic material being lost. Schier (1981) states, "All aspen clones, of course, must have at one time originated from a seedling. In the case of Utah aspen, this perhaps means going back in geologic time to the Pleistocene, when the climate in this region was wetter and more suitable for the establishment of aspen seedlings. Thousands of years of vegetative regeneration (successive generations of shoots arising on a continually expanding root system), in which wildfires played an important role, produced the large clones that exist today."

"Fires are responsible for the abundance of aspen (Populus tremuloides Michx.) throughout much of the mountainous western United States", (DeByle, Bemis and Fischer, 1987). After scrutinizing all of the wildfire ignitions in three Forest Service regions from 1970 to 1982, they determined that approximately 600 acres of aspen burned naturally each year. Of course, these areas were managed in full suppression, but at that rate, they estimate it will take over 12,000 years to burn all of the aspen for the three regions. This is obviously unrealistic as healthy aspen stands must put up new stems every eighty to one hundred and fifty years.

Historically, aspen has burned in the Fishlake area. Fred Baker (1925) reported a fire history study in Ephraim Canyon that included fire scars on aspen trunks. Ephraim Canyon is about 75 miles north of Monroe Mountain and has similar vegetation. During our work, we found no fire scars on aspen trunks, only on the older conifers in the stands. Although aspen stands are now frequently known as 'difficult to burn', Charles Kay (in press) has proposed an interesting theory about human management of aspen stands. He points out that aspen stands can be burned successfully, but usually only in the spring or fall when there are no green leaves on the trees. He hypothesizes that this historical burning was human-caused, as lightning strikes are infrequent during those seasons. A quick check of the lightning seasonality on Monroe Mountain (see graph) shows that the number of strikes are indeed much fewer during the months of April, May, October and November.

ALDS Lightning Data 1985-94
Monroe Mountain Fishlake National Forest

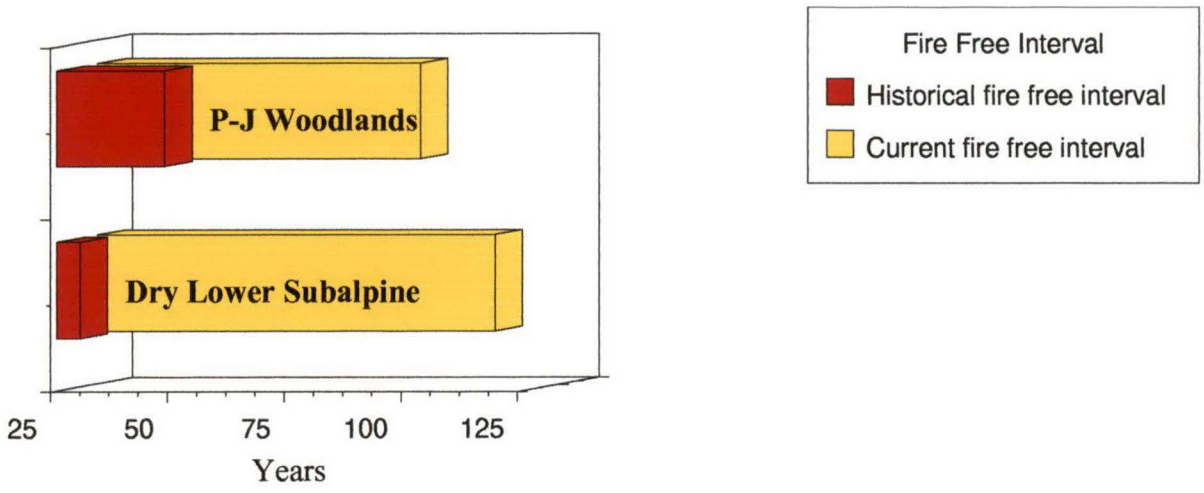


CONCLUSIONS

Please note that all of the mean fire intervals reported here were created by fires hot enough to scar the trees' cambial layer. It is quite probable that there were other lower intensity fires which also burned, but did not create scarring. This lack of scarring would cause longer mean fire intervals to appear in thse data than actually occurred. In other words, we underestimated the number of historic fires occurring on the ground in all of these habitat types.

The current fire regimes on the Monroe Mountain Demonstration Area have been changed from historic regimes. The summaries show the historic mean fire intervals for the three most common habitat types found in the study area. This may be compared with the current number of years since the last fire. All areas examined regardless of habitat type were at least double the length of the historic mean fire interval and have converted to a different dominant vegetation type.

A Comparison Between Historical and Current Mean Fire Intervals



The change in historic fire regimes has resulted in the change in existing vegetation cover types. Now spruce and fir dominate many areas previously covered by aspen and/or ponderosa pine. Due to fire exclusion, through the removal of fine fuels, Douglas fir and some spruce have replaced ponderosa pine on many sites in central Utah. Ponderosa pine needs an open site to establish seedlings, whereas Douglas fir and spruce can successfully reproduce beneath a closed canopy. The lack of frequent, low-severity fires has created a vegetation change to a closed site. This then changes these sites to a long-interval, stand replacing fire regime. Some of the side effects of changing the fire regimes include declining forest health, including increased timber mortality due to insects and disease and loss of aspen acreage.

Managing for the desired vegetation cover on a specific area would improve the above situation. Many tools besides fire may be utilized to modify the environment to meet desired conditions on the ground. Ecosystem management should allow managers to mimic these processes to move toward healthy landscapes in proper functioning conditions.

Opportunities (or other things we still don't know)

The average mean fire interval based on the Fire Group 10 data is 30 years. The interval between fires is widely variable. This could indicate that using the average fire interval to interpret this data is inappropriate. It may be that there is a return fire pattern of shorter and longer fire free intervals as suggested by McBride, Jacobs and Cole, 1995. Checking for possible reburn patterns was not within the scope of this study, but the raw data are available. The same pattern of wide or irregular fire intervals showed up in some of our pinyon-juniper data.

In the pinyon-juniper data the width of the five to 101 year interval may indicate varying frequencies in the mean fire interval. If these data are to be used to determine how often to prescribe a burn, the average mean fire interval may not yield the ecological results expected. McBride, et. al. (1985) suggest that some stands of trees burn at different mean fire intervals. We did not look at the patterns created by the frequency distributions of the burn frequency intervals. This may be appropriate as more data are collected in pinyon-juniper stands in the future.

Historic range of variability data were not collected. This means that for each sample tree, all of the surrounding trees within a 1/10th acre plot are cored and aged to determine the pattern of site stocking (Arno and Sneck , 1977). This information would give a snapshot of the progression of the site through the various stages of succession and corresponding changes in fire regime.

Neither the Fishlake National Forest nor Richfield District Bureau of Land Management have any fuel loading data for this area. Such information would provide baseline information which is currently unknown or very roughly estimated before beginning a prescribed fire program.

Landscape fire patterns were not studied, although they could be as aspen are known to sucker after distrubance. Ages of aspen stands could be used to estimate not only the fire year but possibly fire size and extent as well.

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